

Amendment and Response

Applicant: Raymond H. Kraft

Serial No.: 10/800,420

Filed: March 12, 2004

Docket No.: A126,253.102

Title: SYSTEM AND METHOD OF NON-LINEAR GRID FITTING AND COORDINATE SYSTEM MAPPING

REMARKS

This is responsive to the Final Office Action mailed May 5, 2012 and is in support of the concurrently-filed RCE. In the Final Office Action, claims 1-7, 16-20, and 29-39 were rejected under 35 U.S.C. 112, first paragraph. Claims 1-2, 4-6, 16-17, 19-20, 29-30, and 32-40 were rejected under 35 U.S.C. 103(a) as being unpatentable over Macy et al., U.S. Patent No. 6,538,691 ("Macy") in view of Michael et al., U.S. Patent No. 5,768,443 ("Michael") and Nonay et al., U.S. Patent No. 6,618,494 ("Nonay"). Claims 3, 18, and 31 were rejected under 35 U.S.C. 103(a) as being unpatentable over Macy in view of Michael/Nonay and Thompson, U.S. Patent No. 5,020,123 ("Thompson"). Claims 7 and 35 were rejected under 35 U.S.C. 103(a) as being unpatentable over Macy in view of Michael/Nonay and Leonard et al., U.S. Patent No. 7,034,272.

With this response, claims 1, 2, 16, 29, 30, and 37 have been amended. Claims 1-7, 16-20, and 29-40 remain pending and are presented for consideration and allowance.

35 U.S.C. §112, First Paragraph, Rejections

The Final Office Action does not indicate which features added by amended in the Response filed March 14, 2012 fail to comply with the written description requirement of §112, first paragraph. With the current Response, however, the amendments associated with the March 14, 2012 Response have been deleted or modified. The currently-presented amendments satisfy the requirements of §112, as explained below. Withdrawal of the rejections under 35 USC §112, first paragraph, is respectfully requested

35 U.S.C. § 103 Rejections

Each of independent claims 1, 16, 29 and 37 has been amended in a similar manner. For example, claim 1 is directed toward a method of fitting acquired fiducial data to a set of fiducials on a fiducial plate. As amended, claim 1 recites that an imaging apparatus and the fiducial plate are translated relative to each other in a plane parallel fashion to capture image data. Support for

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this language is found, for example, at page 5, lines 6-9. Local frame fiducial coordinates are mapped to the image data captured by the imaging data by at least in part calculating an absolute location for each captured image feature center relative to a corresponding fiducial on the fiducial plate in fiducial plate coordinates. Support for this language is found, for example, at page 5, lines 18-24. A conversion from coordinates obtained from the image data to ideal fiducial coordinates is established using a data processing component. In this regard, the established conversion is based at least in part on the mapping of local frame coordinates and at least in part on an estimated inter-fiducial spacing of the image data. The inter-fiducial spacing is estimated using at least one of predetermined fiducial pitch, a magnification of the imaging apparatus and a dimension of the image data. Support for this language is found, for example, at page 6, lines 22-24. As a point of reference, the conversion parameters of amended claim 1 are indicative of, but not limited to, fiducial grid model fitting set forth in the specification. A non-linear transformation is employed to quantify at least one of independent scale factors in an X-Y plane, orthogonality errors in a camera pixel arrangement and a keystone distortion in the image data. Support for this language is found, for example, at page 5, line 27-page 6, line 2. The methods of amended claim 1 thus embody capturing image data that includes fiducials, identifying the fiducials the image data and determining a position of a center (map) of each fiducial in terms of an X-Y frame of reference of the imaging device; the mapped locations of the fiducials are effectively fitted to a fiducial grid model using a non-linear fitting function that accounts for inter-fiducial spacing of the image data and effects of possible deviations due to one or more environmental factors.

The cited art, alone or in combination, fails to disclose or reasonably make obvious each and every feature of amended claim 1. In particular, the Final Office Action references Macy as disclosing a method of fitting acquired data to a set of fiducials on a fiducial plate, including translating an imaging apparatus across a plane parallel to the fiducial plate to capture image data. Applicant respectfully disagrees. Macy relates to digital camera systems in which a digital camera is used to capture an image, with the captured image then being transferred to an image display device such as a monitor. According to Macy, the digital image as displayed on the monitor may show geometric distortions. A theoretical “camera grid” is represented, with the

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distorted image represented by a set of pixels in the camera grid. A distortion correction factor specific to the camera in question is determined such that when applied to the camera grid, causes distortion in the camera image to be substantially removed when displayed on the monitor. This correction of digital images pursuant to Macy is premised upon the similarity between a camera grid and a monitor grid. *Macy, col. 3, lines 7-12*. More particularly, the camera grid is first distorted in order to achieve a corrected (undistorted) image; in other words, the contour of the image is deformed while the content of the image is corrected. Second, the monitor grid pixels are mapped onto the camera grid points.

Based on the above explanation, nothing in Macy discloses fitting acquired fiducial data to set of fiducials on a fiducial plate. Nor does Macy disclose capturing image data by translating an imaging apparatus and the fiducial plate relative to each other in a plane parallel fashion. Moreover, Macy is unconcerned with, and does not account for, a relationship between actual features of the object being imaged and the captured image data; instead, Macy simply assumes that the camera has or will take a “distorted” photograph and attempts to remove this assumed “distortion” when the photograph is displayed on a separate monitor. The remaining references cited by the Office Action in rejecting the claims fail to address these deficiencies and one of skill would not reasonably consider modifying the single camera digital photograph display system of Macy in view of the multiple camera machine vision system of Michael. Further, none of the cited references disclose the at least the non-linear transformation and conversion features of amended claim 1.

For at least the above reasons, claim 1 is allowable over the cited art. Independent claims 16, 29 and 37 recite features akin to those identified above in amended claim 1 and thus, for at least these same reasons, are also allowable over the cited art. Claim 2-7, 17-20, and 30-36 depend from allowable claims 1, 16 and 29, respectively and thus are allowable over the cited art for at these same reasons.

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CONCLUSION

In view of the above, Applicant respectfully submits that pending claims 1-7, 16-20, and 29-40 are in form for allowance and are not taught or suggested by the cited references. Therefore, reconsideration and withdrawal of the rejections and allowance of claims 1-7, 16-20, and 29-40 is respectfully requested.

No fees are required under 37 C.F.R. 1.16(b)(c). However, if such fees are required, the Patent Office is hereby authorized to charge Deposit Account No. 50-0471.

Please consider this a Petition for Extension of Time for a sufficient number of months to enter these papers, if appropriate. At any time during the pendency of this application, please charge any additional fees or credit overpayment to Deposit Account No. 500471.

Any inquiry regarding this Amendment and Response should be directed to Timothy A. Czaja at Telephone No. (612) 573-2004, Facsimile No. (612) 573-2005. In addition, all correspondence should continue to be directed to the following address:

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Respectfully submitted,

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